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<b>(51) International Patent Classification 6 :</b> <b>B29D 30/32, 30/24</b>	<b>A1</b>	<b>(11) International Publication Number:</b> <b>WO 98/52740</b> <b>(43) International Publication Date:</b> 26 November 1998 (26.11.98)
<b>(21) International Application Number:</b> PCT/NL97/00435 <b>(22) International Filing Date:</b> 22 July 1997 (22.07.97) <b>(30) Priority Data:</b> PCT/NL97/00290 23 May 1997 (23.05.97) WO <b>(34) Countries for which the regional or international application was filed:</b> NL et al. <b>(71) Applicant (for all designated States except US):</b> VMI EPE HOLLAND B.V. [NL/NL]; Gelriaweg 16, NL-8161 RK Epe (NL). <b>(72) Inventors; and</b> <b>(75) Inventors/Applicants (for US only):</b> GUTKNECHT, Heinz [NL/NL]; Torenweg 26, NL-8161 AT Epe (NL), BIERENS, Franciscus, Cornelis [NL/NL]; Boxhofstede 33, NL-8171 KC Vaassen (NL). <b>(74) Agent:</b> SEERDEN, Adrianus, Maria; Octrooibureau Vriesendorp & Gaade, P.O. Box 266, NL-2501 AW The Hague (NL).		<b>(81) Designated States:</b> AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GE, GH, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW, ARIPO patent (GH, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>In English translation (filed in Dutch).</i>
<b>(54) Title:</b> TYRE BUILDING DRUM WITH TURN-UP APPARATUS		
<b>(57) Abstract</b> <p>Tyre building drum with turn-up apparatus for building an unvulcanized tyre with tyre components (1, 2) and two bead cores (3, 4) with high bead filling strips (4'). Said drum has two ring segments (6, 7) spaced from each other in order to support a bead core, drum segments (8, 9, 10, 11, 12) placed on the outside of each ring segment in order to support the tyre components. Said tyre building drum has means to radially expand that part of the tyre components which is situated between the ring segments. Said tyre building drum has on both sides outside the ring segments a first and second set of axially extending, hingeable arms (11, 12, 17, 19) each having an end directed to the ring segment, said end having a roller (13, 14, 16, 18) and means to axially and radially move each set of arms from a first position in which the rollers of a set of arms form a virtually closed ring to a second position in order to press the expanded part of the tyre components which is situated between the ring segments to the part of the tyre components which is situated outside the ring segments. Each roller (16, 18) of an arm (17, 19) of the second set is situated between two adjacent arms (13, 14) of said first set and situated on the side of the rollers of the arms of said first set which side is turned away from the ring segments.</p>		

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**Tyre building drum with turn-up apparatus**

The present invention relates to a tyre building drum with turn-up apparatus for building an unvulcanized tyre with tyre components of rubber or having reinforcement cords and two bead cores with high bead filling strips, said tyre building drum having a central axis, two ring segments placed around the axis and spaced from each other each to support a bead core, drum segments placed around the axis and on the outside of each of the ring segments, which drum segments define a cylindrical surface to support tyre components, means to radially expand that part of the tyre components which is situated between the ring segments, the tyre building drum having on both sides outside the ring segments a first set of axially extending, hingeable arms, each arm having an end directed at the ring segment, said end having a roller, means to axially and radially move each first set of arms from a first position in which the rollers of a first set of arms form a virtually closed ring to a second position in order to press the expanded part of the tyre components which is situated between the ring segments to the part of the tyre components which is situated outside the ring segments.

Such a tyre building drum with turn-up apparatus is already known from British patent specification 1.532.960. This known tyre building drum comprises two sets of arms, one set on one side outside of the ring segments and the other set on the other side outside of the ring segments. When moving the arms from the first position to the second position, rollers are brought at a greater distance from the axis, as a result of which the rollers are distanced from each other and thus do not form a virtually closed ring any more. Because the second position is a little distance further from the central axis of the tyre building

drum than the first position, the part of the tyre components situated outside the ring segments is not fully pressed over the total height to the part of the tyre components situated between the ring segments, and furthermore the ends of the arms come to stand at a distance from each other so that an incomplete circumferential pressure by the rollers is obtained. In order to prevent an incomplete attachment of the tyre components, which may be detrimental to the quality of the tyre to be produced, a sleeve of rubber is applied around the arms. Such a sleeve of rubber however, has a limited life span.

The object of present invention is to provide a tyre building drum with turn-up apparatus for building an unvulcanized tyre with tyre components of rubber or having reinforcement cords and two bead cores with high bead filling strips, wherein without the use of a rubber sleeve the parts of the tyre components can be pressed to one another over their full circumference and their full height, so that the final quality of the tyre to be produced is improved.

For this purpose a tyre building drum with turn-up apparatus of the kind described above is according to the invention characterized in that each first set of arms contains a second set of axially extending, hingeable arms, each arm having an end directed at the ring segment, said end having a roller, each roller of an arm of the second set being situated between two adjacent arms of said first set and being situated on the side of the rollers of the arms of said first set which side is turned away from the ring segments, and that means are provided to axially and radially move each second set of arms from a first position, in which the rollers of a second set of arms form a virtually closed ring to a second position in order to press the expanded part of the tyre components which is situated between the ring segments to the part of the tyre

components which is situated outside the ring segments. Because the rollers of the arms of the second set are situated between the arms of the first set, at least almost the entire circumference of the tyre component parts is pressed to one another in the second position of the rollers of both sets, as a result of which an at least almost complete attachment of the tyre components is obtained.

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10 A preferred embodiment of a tyre building drum with turn-up apparatus according to present invention is characterized in that the means to axially and radially move each first set of arms and the means to axially and radially move each second set of arms are formed by the same means. In this way the turn-up apparatus of the tyre building drum cannot  
15 only be manufactured in a more compact design, but also moving the sets of arms from the first position to the second position is synchronized in a simple way.

20 A further preferred embodiment of a tyre building drum with turn-up apparatus according to the invention is characterized in that means are provided for laterally supporting the two bead cores with high bead filling strips, wherein the means are situated between the ring segments and preferably are pivotable from a non-working position to a  
25 working position. In this way it is prevented that when the arms are going from the first position to the second position, the arms push the bead cores with high bead filling strips from their places. When the means are  
30 pivotable from a non-working position to a working position, the normal working of the tyre building drum is not detrimentally influenced.

35 By way of example, some embodiments of a tyre building drum with turn-up apparatus according to the invention will be described on the basis of the drawing. Therein:

Figure 1 schematically shows a longitudinal cross section of an tyre building drum with turn-up apparatus according to the invention, the arms being in the first position,

5 Figure 2 schematically shows a longitudinal cross section of an tyre building drum with turn-up apparatus according to the invention, the arms being in the second position and the part of the tyre components which is situated between the ring segments, being expanded,

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Figure 3 schematically shows a longitudinal cross section of an alternative embodiment of the tyre building drum with turn-up apparatus according to the invention, wherein in the left half of the figure the arms are shown in the first position and in the right half of the figure the arms are shown in the second position,

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Figure 4 schematically shows in perspective one set of arms in a first position and some parts of the turn-up apparatus of the tyre building drum according to the invention in order to exemplify the three-dimensional configuration, and

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Figure 5 schematically shows in perspective one set of arms in a second position and some parts of the turn-up apparatus of the tyre building drum according to the invention in order to exemplify the three-dimensional configuration.

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Figure 1 schematically shows a longitudinal cross section of the tyre building drum with turn-up apparatus according to the invention for building an unvulcanized tyre. Such an unvulcanized tyre contains tyre components of rubber or having reinforcement cords (of which in figure 1 two, 1 and 2 are shown) and two bead cores 3 and 4 with high bead filling strips. The number and kind of tyre components are dependent on the final tyre to be produced, and the possible assemblies and construction are sufficiently known to

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an expert, so a more detailed discussion of this will be omitted.

5 The tyre building drum has a central axis 5. Around the axis 5 and spaced from each other two ring segments 6 and 7 are situated, each to support a corresponding bead core 3 respectively 4. Around the axis 5 and on the outside of each ring segment 6, 7 drum segments 11 and 12 are situated, which drum segments define a cylindrical surface  
10 to support the tyre components 1, 2. The ring segments 6, 7 can also serve to support certain tyre components, such as relatively narrow reinforcement strips.

15 Figure 1 shows an example of a tyre building drum, in this case also with drum segments 8, 9 and 10 between the ring segments. As already known there are means (not represented in the figure) to radially move at least a part of the drum segments (particularly drum segment 8), and means (not represented in the figure) to - for instance by way of air  
20 pressure - radially expand that part of the tyre components which is situated between the ring segments 3, 4.

The tyre building drum on both sides outside the ring segments 6, 7 has a first set of axially extending, hingeable  
25 arms 11 respectively 12. Each arm 11, 12 has an end directed at the ring segment 6, respectively 7, said end having a roller 13, respectively 14. As already known there are means (15, figure 2) to axially and radially move each first set of arms 11, 12 from a first position  
30 (represented in figure 1) in which the rollers 13, 14 of a first set of arms 11, 12 form a virtually closed ring to a second position (represented in figure 2) to press the expanded part of the tyre components which is situated between the ring segments 6, 7 to the part of the tyre  
35 components which is situated outside the ring segments 6, 7.

In the following the feature of the tyre building drum which is essential for the invention will be further gone into, which is the turn-up apparatus, and other components of the tyre building drum, which are sufficiently known to the expert, will not be described in detail.

According to the invention a tyre building drum with turn-up apparatus is provided in which each first set of arms (11 or 12) contains a second set of axially extending hingeable arms (17 respectively 19, see figure 2 and 4). Each arm 17, 19 of each second set has an end directed at the ring segment 6 respectively 7, said end having a roller 16 respectively 18. Each roller 16, 18 of an arm 17, 19 of each second set is situated between two adjacent arms 11, 12 of the said first set, each roller 16, 18 of the second set being situated on the side of the rollers 13, 14 of the arms 11, 12 of said first set, which side is turned away from the ring segments 6, 7.

Furthermore there are means, preferably the means 15, to axially and radially move each second set of arms from a first position in which the rollers 16, 18 of the second set of arms 17, 19 form a virtually closed ring to a second position in order to press the expanded part of the tyre components which is situated between the ring segments 6, 7 to the part of the tyre components which is situated outside the ring segments 6, 7. The means to axially and radially move the set of arms preferably comprise flexible bands, arranged around the set of arms in order to press the arms from the second position back to the first position.

Because the rollers 16, 18 of the arms 17, 19 of the second set are situated between the rollers 13, 14 of the arms 11, 12 of the first set, in the second position of the rollers of both sets almost the entire circumference of the tyre component parts is pressed to one another (as represented



in figure 2 and 5) as a result of which an almost complete attachment of the tyre components is obtained.

Figure 3 schematically shows a longitudinal cross section (only the upper half is shown, the lower half is symmetric) of an alternative known embodiment of the tyre building drum with turn-up apparatus according to the invention for building an unvulcanized tyre. Such an unvulcanized tyre consists of tyre components of rubber or having reinforcement cords, of which in the right half of figure 3, two, 1' and 2', are shown, and two bead cores with high bead filling strips, of which only one 4' is shown. The tyre building drum has a central axis 5'. Around the axis 5' and spaced from each other two ring segments 6' and 7' are situated, each to support a corresponding bead core. Ring segments 6' and 7' serve to support the tyre components 1' and 2'. Initially two sets of arms 11', 17' and 12', 19' when they are in the first position are used for supporting the part of the tyre components that is outside the ring segments. Each arm 11', 12' (17', 19') has an end directed at the ring segment 6', respectively 7', said end having a roller 13', respectively 14' (16', 18'). Each set of arms can be moved from a first position (shown in the left half of figure 3) in which the rollers of a set of arms form a virtually closed ring to a second position (shown in the right half of figure 3) in order to press the expanded part of the tyre components that is between the ring segments 6', 7' to the part of the tyre components which is outside the ring segments 6', 7'.

Each roller 16', 18' of an arm 17', 19' of each second set is situated between two adjacent arms 11', 12' of said first set, each roller 16', 18' of the second set being situated on the side of the rollers 13', 14' of the arms 11', 12' of said first set, which side is turned away from the ring segments 6', 7'.

Because the rollers 16', 18' of the arms 17', 19' of the second set are situated between the rollers 13', 14' of the arms 11', 12' of the first set, in the second position of the rollers of both sets, almost the entire circumference of the tyre component parts are pressed to one another, wherein also without the use a sleeve of rubber an almost complete attachment of tyre component parts is obtained.

Furthermore means 20, 21 (figure 3) are provided to laterally support said two bead cores with high bead filling strips of which one 4' is shown in figure 3, in which the means are situated between the ring segments 6', 7'. Said means, when in working position, prevent that the arms when going from a first position to a second position, from unwontedly pushing the bead cores with high bead filling strips from the ring segments. Preferably the means 20, 21 for laterally supporting the bead cores with high bead filling strips are pivotable from a non-working position to a working position. In this way the means for laterally supporting the bead cores with high bead filling strips do not impede the normal working of the tyre building drum, and moreover can help supporting the tyre components in the starting position.

25 AS/NG

**Claims**

1. Tyre building drum with turn-up apparatus for building an unvulcanized tyre with tyre components of rubber or having reinforcement cords and two bead cores with high bead filling strips, said tyre building drum having a  
5 central axis, two ring segments placed around the axis and spaced from each other each to support a bead core, drum segments placed around the axis and on the outside of each of the ring segments, which drum segments define a cylindrical surface to support tyre components, means to  
10 radially expand that part of the tyre components which is situated between the ring segments, the tyre building drum having on both sides outside the ring segments a first set of axially extending, hingeable arms, each arm having an end directed at the ring segment, said end having a  
15 roller, means to axially and radially move each first set of arms from a first position in which the rollers of a first set of arms form a virtually closed ring to a second position in order to press the expanded part of the tyre components which is situated between the ring segments to  
20 the part of the tyre components which is situated outside the ring segments, **characterized in that**, each first set of arms contains a second set of axially extending, hingeable arms, each arm having an end directed at the ring segment, said end having a roller, each roller of an arm  
25 of the second set being situated between two adjacent arms of said first set and being situated on the side of the rollers of the arms of said first set, which side is turned away from the ring segments, and that means are provided to axially and radially move each second set of  
30 arms from a first position in which the rollers of a second set of arms form a virtually closed ring, to a second position in order to press the expanded part of the

- 10 -

tyre components which is situated between the ring segments to the part of the tyre components which is situated outside the ring segments.

- 5     2. Tyre building drum with turn-up apparatus according to claim 1, **characterized in that**, the means to axially and radially move each first set of arms and the means to axially and radially move each second set of arms are formed by the same means.
3. Tyre building drum with turn-up apparatus according to claims 1 or 2, **characterized in that**, means are provided to laterally support the two bead cores with high bead filling strips, wherein the means are situated between the ring segments.
4. Tyre building drum with turn-up apparatus according to claim 3, **characterized in that** the means to laterally support the bead cores with high bead filling strips are pivotable from a non-working position to a working position.

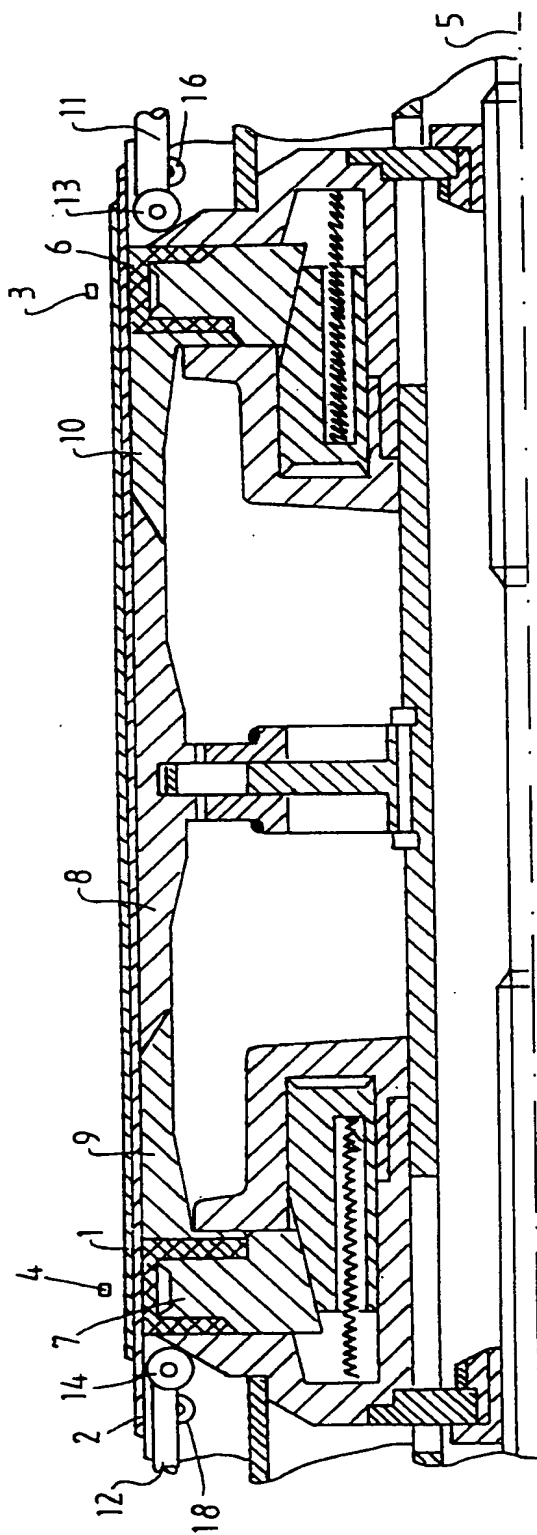
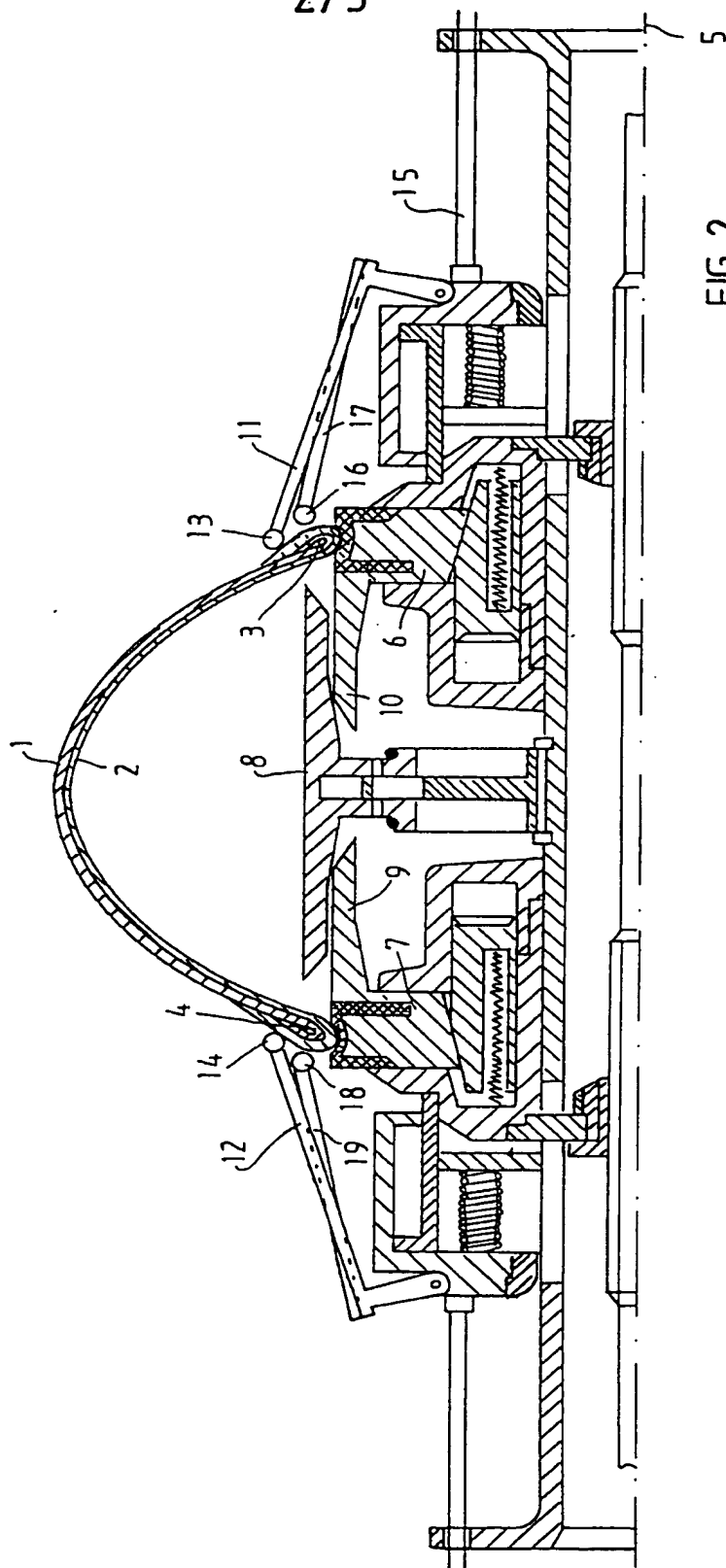


FIG. 1

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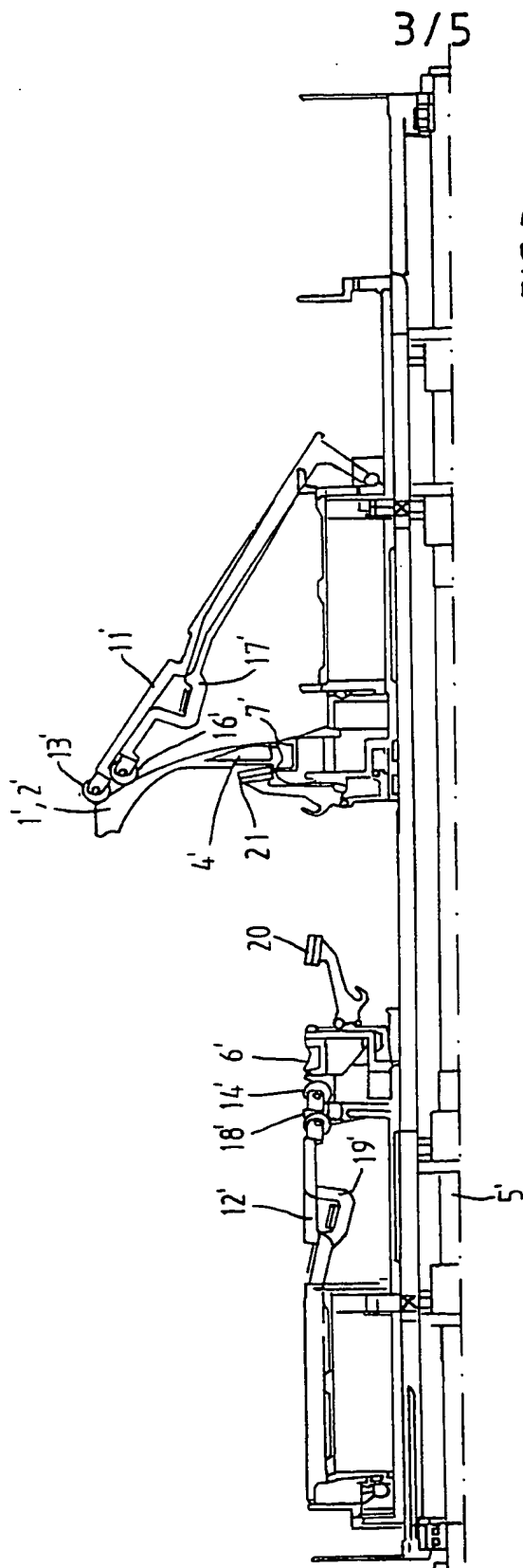


FIG. 3

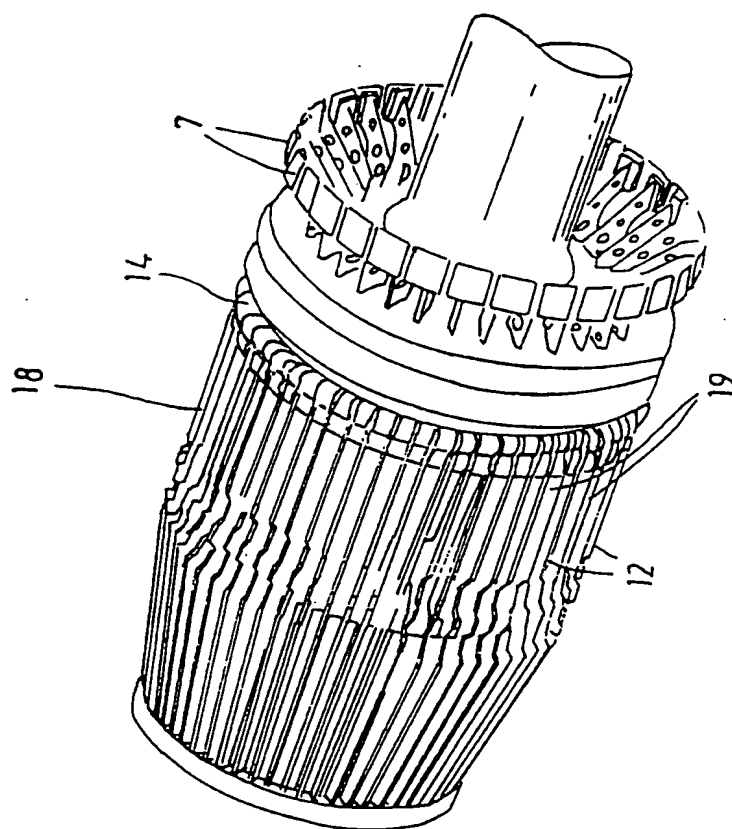


FIG. 4



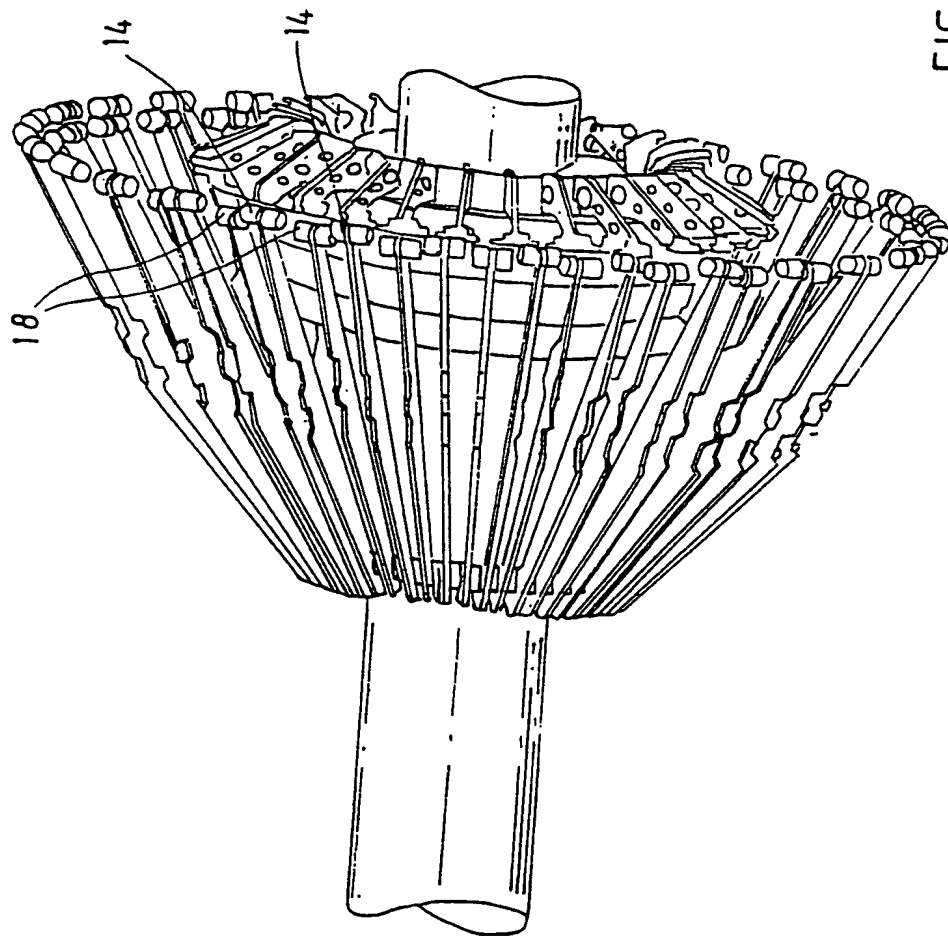


FIG. 5

# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/NL 97/00435

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 B29D30/32 B29D30/24

According to International Patent Classification(IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 B29D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	FR 2 294 043 A (AVON TYRES LTD) 9 July 1976 cited in the application see the whole document ---	1
A	GB 2 182 894 A (BATES W & A LTD) 28 May 1987 see the whole document ---	1
A	US 4 362 592 A (RUPPEL DONALD B) 7 December 1982 see the whole document ---	1
A	EP 0 637 505 A (MICHELIN & CIE) 8 February 1995 see the whole document ---	1
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Further documents are listed in the continuation of box C.



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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	GB 2 081 189 A (NATIONAL-STANDARD COMP.) 17 February 1982 see page 3, line 109 - line 123; figures 2-9 ---	3,4
A	EP 0 459 728 A (BRIDGESTONE CORP.) 4 December 1991 see column 5, line 35 - column 7, line 12; figures 4A-4C see column 3, line 58 - column 4, line 16; figure 3 -----	3,4

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